Иновације у настави, XXXVI, 2023/4, стр. 61–79 UDK 781.62 371.212.2
DOI: 10.5937/inovacije2304061S

Рад примљен: 30. 8. 2023.
Рад прихваћен: 21. 11. 2023.

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Оригинални научни рад

Rhythm Responses of Preschool, First and Second Grade Children in Different Tasks of Duplicating Rhythmical Patterns

***Summary**: Enrolment exam for music schools is an important moment when a child potentially, in parallel with attending general education, starts attending specialized, music education. In this paper we are questioning the existing concept of evaluating rhythmic abilities within the entrance exam for music schools. This evaluation currently includes duplicating rhythmical patterns, performed through one of two tasks: first one involves clapping the beat while performing the rhythmical patterns vocally, using the neutral syllable and the second one includes duplicating rhythmical patterns only through clapping. Nevertheless, in pedagogical practice the choice between the two tasks is usually arbitrary, since it is assumed that the results on both types of tasks would be similar. Furthermore, the level of difficulty of the given patterns within the test is arbitrary, since the teachers are usually inventing them „in situ" for each child. All respondents are evaluated in the same way, regardless of their age (which usually varies from 6 to 8). The aim of this paper is to contribute to the potential improvement of the quality and fairness of the enrolment exam for all participants, through investigation of the possible differences in the results of the same participants on two types of tests and comparing the results between the tasks with different level of difficulty, between the three age groups of children and between the two genders. The research was carried out within both – elementary school and preschool facilities in Belgrade and the sample consisted of 278 children. The results revealed that participants were more successful in the first type of task. Statistically significant differences were found between participants of different gender in their achievement in favour of girls and also between participants of different age groups, in favour of the second graders. Pedagogical implications were defined, regarding (1) transformation of traditional testing procedures regarding evaluating children's rhythmical abilities within enrolment exams in Serbian music schools, as a base for optimal selection of children and indirectly, optimal results of the teaching process in music schools and (2) the content of teaching and activities in elementary schools and preschools in the field of rhythm.*

***Keywords**: Duplicating rhythmical patterns, rhythmical abilities, preschool music education, general music education, music school.*

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Introduction

Rhythm, in a broadest meaning of this term, is a primary component of music (LOT, 2014: 685), the factor of time dimension of music (Despić, 1997: 43), or the primary element that creates the perception of time (Thaut, 2013: 15). A generally accepted definition of rhythm does not exist. In a broad sense, rhythm is considered to be a complex reality composed of several variables – distinct temporal components or sub-elements such as beat, tempo, meter and (rhythmic) pattern (Fraisse, 2013; Thaut et al., 2014). In her extensive study dedicated to rhythm, Vasiljević (1999) discusses numerous definitions, singling out Gostuški's definition as the most characteristic one: "Rhythm represents the relationship between the duration and accent. Accents are points of orientation limiting the segment of duration" (Gostuški, 1968: 193, as cited in Vasiljević, 1999: 189).

At the principal level of organization of timing in music is a basic beat (or "tactus"), a unit of musical pulse, audible, or, more often must be inferred and it occurs regularly, in a certain tempo. The next level of music organization, meter, involves "higher-level groupings of single events (or beats) into a hierarchical structure in which some events are stressed ('strong') and others are not ('weak')" (Kotz et al, 2018). Colwell defines meter as "regular cycles of strong and weak accents" (Colwell, 2006: 106). On the surface of this structure is the "timing of the musical events" – the rhythmic figures and patterns, composed of different note durations and pauses. Rhythmic figures and patterns are difficult to be perceived individually from meter – "meter serves as a temporal ground for the perception of rhythmic figures" (London, 2004: 48). In an effort to make a clear distinction between these two terms, London (2001) states that "rhythm involves the pattern of durations that is phenomenally present in the music, while metre involves our perception and anticipation of such patterns."

Rhythmical ability (perception and reproduction of rhythm) is considered to be one of the most important components of musical ability (Mirković Radoš, 1996). Vasiljević defines several elements of rhythmical abilities, including „the ability to maintain an steady beat and the ability to group beats, the ability to adapt to a given tempo, the ability to perceive and perform different rhythmic types, the ability for agogic nuancing, the ability to polyphonically follow different rhythmic relationships between voices" (Vasiljević 2006: 172). The multidimensional nature of rhythm itself implies there would be differences in performance on different rhythmic tasks, involving the use of multiple dissociable rhythmic skills (Bonacina et al., 2019; Bonacina et al., 2021, Dalla Bella et al., 2017; Fiveash et al., 2022; Tierney & Kraus, 2015). The research relying on the neuroimaging confirmed that distinctly different brain activity was elicited during tasks which include processing of pattern, meter, and tempo (Peretz & Zatorre, 2005; Thaut et al., 2014).

In the past, the researchers have developed different tools for assessing musical ability, and more specifically, rhythmic ability. Seashore provided measures of 6 musical aptitudes, containing the test of discrimination between pairs of rhythmic models (Seashore, Lewis & Saetveit, 1956). Gordon's prominent Primary Measures of Music Audiation test consists of two subtests, Tonal and Rhythm, the latter including the task where children must decide whether pairs of tonal or rhythm patterns they hear sound the same or different (Gordon, 2001)[2]. Many other tests, including Rhythmic Competency Analysis Test (RCAT) by Weikart (1982), Beat Alignment Test (BAT) by Iversen and Pattel (2008), Harvard Beat Assessment Task (H-BAT) by Fujii and Schlaug (2013), tests of observation and movement (Kokas, 1969) have been developed and used. They contain various tasks in which the perception and reproduction of rhythm is evaluated, but most of them contain versions of two tasks: the rhythm reproduc-

2 Find more detailed review of musical ability tests in Mirković Radoš's *Psihologija muzike* (1996), pp. 58–93.

tion task and synchronizing one's movements with an isochronous beat. These tasks are also part of the learning process, within music lessons in school or music activities in the preschool setting, aimed to enhance the development of rhythmical abilities.

Rhythm reproduction task is a task where an individual remembers and duplicates rhythmic patterns as precisely as possible, right after hearing them. The task consists of an input – a given pattern, and an output – an attempt of its duplication by the individual. An input in this specific task is a rhythmic pattern, reproduced through auditory modality[3], digitally (Drake, 1993), or performed in person by a teacher/investigator, through clapping hands, tapping a finger, or chanting a pattern with neutral syllable (Levinowitz, & Scheetz, 1998). If it is reproduced digitally, the reproduction is usually an audio sample or a recording of the pattern (Gardner, 1971). In the output the individual repeats the pattern in the same way the original was performed, or in some of the ways listed above, for example, plays it on a percussion instrument (Drake, 1993), sometimes including a vibration-sensitive drum trigger pressed against the underside of the head of the drum (Bonacina et al., 2019; Tierney & Kraus, 2015) or in recent days, repeats it by tapping the electronic pad or a key on computer keyboard (Grahn & Schuit, 2012).

Synchronizing one's movements with music, more specifically with music pulse, or beat is a task that seems very simple, but in reality, it is a complex process and its execution is dependent on the auditory processing, sensorimotor (auditory-motor) synchronization ability and fine motor control (Tierney & Kraus, 2013). Sensorimotor synchronization involves "the temporal coordination of a motor rhythm with an external rhythm" (Repp, 2005: 969), and auditory-motor synchronization implies coordination with auditory stimulus (Mares et al., 2023). Tapping to the beat requires "using the identified metrical structure to predict upcoming auditory events and to pace movement" (Kung et al., 2013). "Regardless of the fact that motor skills during preschool age are not yet fully defined, this period is very important in developing, especially basic, general motor skills (…), on the basis of which they will continue to develop specific motor skills." (Džinović Kojić & Pelemiš, 2016: 31). Fine motor control is not fully established during the early childhood, its development continues through later childhood, during primary school years (Goodway, Ozmun & Gallahue, 2019). The ability to perform bimanual patterns represents a major developmental transition in childhood, especially during period between the age of 6 and 12 years (Serrien, Sovijärvi-Spapé, & Rana, 2014). A study examining both the development of sensorimotor synchronization in children in the age range from 5 to 8 years and the involvement of motor and cognitive capacities showed that differences in synchronization performance are mainly linked to the development of motor rather than cognitive abilities (Monier & Droit-Volet, 2019).

There are several variants of movement synchronization task used in different studies – following the beat with movements such as finger tapping, clapping hands, comparing different movements, such as patting the knees with parallel hands, dominant, or non-dominant hand (Derm et al., 2001; Pollatou et al., 2005), drumming to the beat (Bonacina et al., 2019) or using accelerometer sensors to record, compare, and appraise coordinated motions of subjects' body parts (Kyriazis et al., 2018). Finger tapping is nowadays usually measured in the lab setting, using tapping pads (Tierney & Kraus, 2013) or sensors, and some attempts have been made to start using mobile devices like tablets and smartphones (Zanto et al., 2019). One variant of this task includes a period of silence, when the subject is asked to continue tapping as if the sound were still present. That way, "the subject's ability to produce a steady beat at a particular rate without needing to synchronize to

3 In different versions of this tasks, the input may additionally be presented visually, or kinaesthetically.

an auditory stimulus" is being evaluated (Tierney & Kraus, 2013: 229).

Various underlying causes are identified to influence individual differences in rhythmic ability, such as short-term memory capacity, sensitivity to the presence of regular temporal structure, musical training (Grahn & Schuit, 2012; Grujić 2008; Grujić, 2009), but also age (Grujić-Garić, 2017), cultural factors, etc.

Some of the previous research in this field lead to conclusions that age level is a significant predictor of rhythmic development and affects children's rhythmic performance (Bonacina et al., 2019; Elisana et al., 2012; Gardner, 1971; Lee, 2008; Mastrokalou & Hatziharistos, 2007; Weikart, 1982). Between the ages of six and nine there is a rapid development of rhythmic aspects of musical abilities (Mirković Radoš, 1988). Ability to synchronize with a beat appears around age of four (Patel, 2010) and significantly develops between 5 and 7 years of age (Hargreaves, 1986). Rhythmic pattern reproduction ability also significantly improves between age 5 and 7 (Drake, 1993), and continues to improve by the age of 9 (Schleuter & Schleuter, 1985). Drake, Jones, and Baruch (2000) confirmed that synchronizing ability improved significantly with age, in their research which involved children ages 4, 6, 8, and 10 (see more details in Reifinger, 2006).

The research investigating the possible differences between sexes in mastering these tasks are inconclusive. Majority of them show that there are no differences between the sexes (Lee, 2008; Mastrokalou & Hatziharistos, 2007; Thomas & Moon, 1976), but some of them found that girls outperformed boys in the tasks, or some of its versions (Derm et al., 2001; Elisana et al., 2012; Pollatou, et al., 2005; Schleuter & Schleuter, 1985).

A limited amount of research was conducted which compared the modalities of presenting or repeating rhythmic patterns, but in his research, Lee confirmed that children at all age levels have better results in duplicating patterns while chanting, then they do when tapping (2008). Schleuter and Schleuter (1985) found that preschool children, Grade 1 and 2 pupils responded most accurately by chanting, and Grade 3 pupils exhibited the highest accuracy when clapping out rhythmic patterns. Previous research are showing an individual may struggle in one rhythmic task yet perform well in another one (Bonacina et al., 2019; Bonacina et al., 2021; Dalla Bella et al., 2017; Tierney & Kraus, 2015).

In Serbian preschools there are different activities aimed at fostering children's rhythmical development. For example, short guidelines for using nursery rhymes, together with nursery rhymes examples are present in the first informal textbook for preschool teachers in Serbia, published back in 1898. (Stojšić, 1898). According to Sokolović Ignjačević (2020), in instructional literature and official programs for preschool education in Serbia, there are guidelines for using different rhythmical games and performing rhythmical accompaniment to singing or reciting nursery rhymes, including performing steady beat, grouping of the beats, rhythm, by clapping or using the instruments. Duplicating the patterns is not a task that is usually mentioned.

In Serbian primary schools, the development of rhythmic abilities continues and progresses through music education classes, starting from the first grade and continuing throughout the school years. In the initial two grades of Serbian primary schools, in the field of music performance, the music curriculum incorporates an ear-based learning method for teaching chants in order to improve pupils' rhythmical abilities (*Pravilnik o planu nastave i učenja za prvi ciklus osnovnog obrazovanja i vaspitanja i programu nastave i učenja za prvi razred osnovnog obrazovanja i vaspitanja*, 2017; *Pravilnik o programu nastave i učenja za drugi razred osnovnog obrazovanja i vaspitanja*, 2018). A chant is rhythmically recited and is consistently accompanied by a fitting movement. The movement that follows the chant can vary, encompassing actions like snapping fingers, clapping hands, stepping, or placing your

palm against the back of your hand etc. and represent the execution of a pulse, a rhythm or a grouping of beats. These activities hold significant importance in fostering rhythm skills among children and serve as preparatory exercises for playing musical instruments. It is recommended to incorporate these activities into each and every class.

Engaging in more complex tasks – which include precise synchronization of movement with music listening, or performing, presents a distinct challenge. Activities that are integral to pedagogical practices within both preschool institutions (see more details in Sokolović Ignjačević, 2020) and primary schools are different music games and traditional games with singing. Moreover, they often require a high level of coordination between movement and musical rhythm, fostering a holistic learning experience for the participants.

Public school system in Serbia, apart from general primary schools includes specialist music schools, where children learn to play music instruments and the basics of the music literacy. After enrolling and completing primary music schools, some of the children continue their education in public music secondary schools, and the ones with outstanding results pursue their education at academic level at one of the Faculties of Music Arts. Since the resources are limited, and "the best way to ensure that resources were well used was to select children on the basis of ability" (Hallam, 2006: 55), the enrolment exam, where children's music aptitudes are evaluated through a short series of tasks is considered necessary.

Enrolment exam for music schools is an important moment when a child potentially, in parallel with attending general education, starts attending specialized, music education. Evaluation of children's music abilities is not completely standardized on the national level, but it is traditionally performed in a certain way. In the official document it is only listed that "The enrolment exam includes tests of hearing, rhythm and musical memory" (*Nastavni plan i program osnovnog muzičkog obrazovanja i vaspitanja*, 2010: 8). Usually, there are several tasks it consists of. Specifically, children's rhythmic abilities are usually evaluated through one of two tests:

1. a test where children are duplicating rhythmic patterns vocally, using neutral syllable while they are the reproducing the steady beat by clapping hands (test A);

2. a test where children are duplicating rhythmic patterns by clapping hands (test B).

Which one of these two tests will be performed is arbitrary and depends on the decision of the team of teachers who are carrying out the enrolment exam. Children attending the enrolment exam are not divided into age groups – they usually attend the test at age of 6 to 9, and their results are evaluated in the same way, regardless of their age. Moreover, the difficulty of the given test is arbitrary, since the teachers are usually inventing them *in situ* for each child.

Similar two tests are usually a part of a process of evaluation of musical abilities of students, as a part of enrolment exams for teacher training faculties in Serbia.

The idea for this research derived from practise – we have observed that the current enrolment exam testing procedure can lead to lower performance for children who are either unfamiliar with the testing process (due to the fact many of them have never performed these tasks within music classes/activities in schools and preschools and had less music engagement and experiences within the music teaching context, in general) or younger than their peers. Since many recent studies have shown that there are differences in individual's performance across different rhythmic tasks (Bonacina et al., 2019; Bonacina et al., 2021; Dalla Bella et al., 2017; Tierney & Kraus, 2015), we wanted to investigate possible differences in results on these tests between participants. Similar research in Serbia, with more broad focus on all music abilities were conducted by Nikšić (2009) and Sudzilovski and Terzić (2002).

Methodology

The aim of this paper is to contribute to the potential improvement of the quality and fairness of the enrolment exam for all participants, through investigation of the possible differences in the results on duplicating rhythmic patterns in two different ways (test A and test B) and comparing the results between the tasks with different level of difficulty, between the three groups of children (preschool, first and second grade of primary school) and between the two genders.

The research was conducted in June and December 2022. Research questions related to this goal are as follows:

1. Whether children are more successful when they duplicate the rhythmic patterns vocally, using neutral syllable while they are the reproducing the steady beat by clapping hands or when they duplicate rhythmic patterns by clapping hands?

2. Are children more accomplished in duplicating rhythmic patterns in simple or complex tasks:

a) in reference to duplicating rhythmic patterns vocally, using neutral syllable while they are the reproducing the steady beat by clapping hands (test A);

b) in reference to duplicating rhythmic patterns by clapping hands (test B)?

3. Are there any differences between the sexes when it comes to duplicating rhythmic patterns in two different ways?

4. Whether there are differences in successfully duplicating rhythmic patterns between participants of different age groups in two different ways?

Subjects

The subjects were attending randomly selected preschool institutions from Zemun, Belgrade, and a primary school "Branko Copic" in Belgrade. A total of 278 children, divided into three age groups, participated in the study: preschool children (84), first-grade pupils (85) and second-grade pupils (109). Among the total of 278 subjects, 149 were girls, while the remaining 129 were boys. The reason behind incorporating both preschool children and those in the first two grades of primary school, apart from the fact this age group represents the most common attendees of enrolment exams at music schools in Serbia, due to the duration of the elementary music education, is the fact that this is a developmentally sensitive period, which is very important for future progression of rhythmical abilities (Pound & Harrison, 2002; Schleuter & Schleuter, 1985; Sudzilovski & Terzic, 2010; Vasiljević, 2003).

Materials

To develop an instrument for this research, we sought the expertise of music pedagogues who serve as examiners during enrolment exams at music schools. They generously shared their experience regarding the types of examples they typically employ during the testing process. We also used the examples of rhythmic patterns from the previous, similar research (Drake, 1993; Persellin, 1992), as guidelines for creating our own instrument.

Eight short musical rhythms were constructed around four beats thus – all were of the same total duration and they were all reproduced with a 60 beats/time tempo, following the findings that there is a preference for beats that occur roughly every 500-700 ms (Patel, 2010: 100). Rhythms are divided into two groups: simple and complex rhythms (Figure 1).

Seven examples contain binary subdivision, while the eighth contains ternary subdivision. In the simple group of rhythms there are two that consist of only two different durations. The rest of examples have three different durations or more. The suitability of patterns was evaluated through a short pilot study, with sample of 30 participants from primary school "Sava Sumanovic" in Zemun. The pilot study indicated that the participants successfully reproduced all the provided examples, confirming the sufficiency of the number of examples. Due to the concise nature of the assessment, the subjects closely followed the examiner's instructions.

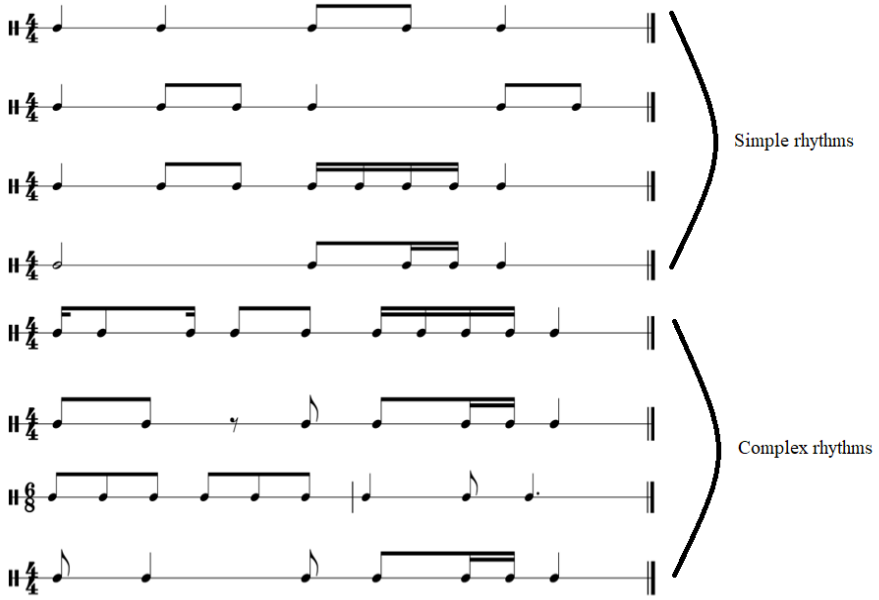

Figure 1. Rhythmic patterns for duplication – simple (4) and complex (4) rhythms.

Procedure

Each subject was tested twice, once for the test B, duplicating rhythmical patterns by clapping hands and once for the test A duplicating the same patterns vocally, using neutral syllable while clapping the beat. The tests were assigned to subjects randomly in the counterbalanced order – half of the subjects were assigned with the test A followed by the test B and the other half had the test B first, followed by the test A. The second round of testing occurred approximately 10 days after the first round. To ensure accurate testing of rhythm performance, the examples were systematically alternated in pairs, featuring two simpler ones followed by two more complex ones. The subjects were tested individually in a quiet room in the preschool facility or in the school. During the testing, they were constantly praised and encouraged to focus. Each experimental session lasted approximately 3 minutes.

The subjects were given the instruction to repeat the rhythm in the same way as they were shown, whether it was vocally, using neutral syllable while clapping the steady beat or by clapping hands. They heard each rhythm once, performed by the interlocutor. There was a pause of about one beat between the end of a reproduction and the presentation of the next rhythm. Within the session, all of the rhythms (total of eight) were presented.

In regard with rating the results, there were two possible paths to follow. First one included rating only the accuracy of the rhythmic patterns reproduced in two ways – vocally and by clapping, excluding the evaluation of performance of music pulse. This approach could be interesting, in order to investigate whether, as stated before, meter does serve as a temporal ground for the perception of rhythmic figures (London, 2004). Second one included rating success of performance as a whole, including meter and rhythm in test A, and rhythm

only in test B. Given that this is the method rhythmic abilities are being evaluated within the enrolment exams, this is the approach we opted for in current research; however, in future research, we plan to use the first approach as well.

Two independent raters evaluated the subjects' results. Each rhythmic pattern in both tests was assigned a value of eight points – two points were assigned for correct replication of rhythmic pattern within each beat and participants could reach a maximum of 64 points within each test[4]. Any individual discrepancy between scores was reviewed a third time. Obvious scoring mistakes were corrected, but judgment decisions on the part of the scorers were allowed to stand and were averaged to calculate a final score.

For data processing we used SPSS. The performances of the participants were analysed using descriptive statistical measures. In order to examine if test scores have normal distribution we used the Kolmogorov-Smirnov normality test. Intending to determine statistical differences between the sexes in duplicating rhythmic patterns we ran the Mann-Whitney U test. For determining statistical differences in successfulness both – in different ways of duplicating rhythmic patterns and in different age groups, we used Wilcoxon Signed Rank Test. Further, to determine the correlation between two ways of replicating rhythms we used Spearman's rank correlation coefficient.

Results and Discussion

Our first research question refers to compare the results of each subject on both tests / determine whether children are more successful when duplicating the rhythmic patterns vocally, using neutral syllable while reproducing the steady beat by clapping hands (test A), or when duplicating rhythmic patterns by clapping hands (test B). Children could reach the maximum of 64 points on each of the tests. Figure 2 shows the distribution of scores on test A and test B within the sample, ordered by score value. Note the difference in curve shapes – sum of points in test B produced a continuous distribution of results ranging approximately from 10 to 64, while in test A only 45 participants acquired less than 40 points.

A comparison was made between the outcomes attained in both tests. Wilcoxon Signed Rank Test (z = -9,445; p = 0,00) indicates a statistically significant difference in children's successfulness when they duplicate rhythmical patterns vocally, using neutral syllable while reproducing the steady beat by clapping hands (test A) (*Mdn* = 53) and duplicating rhythmic patterns by clapping hands (test B) (*Mdn* = 47). Figure 3 illustrates the subtraction between the sum of points achieved on the test A and the sum of points achieved on the test B. In this analysis of the results of 277 participants, 199 of them demonstrate higher success rates in test A (dots in the field above the value 0 in the graph above), while 65 of them show greater success in test B (dots in the field below the value 0 in the graph above). 13 students achieve the same number of points, irrespective of the test. The mean score of correct response for test A is *M* = 50,89 (*SE* = 0,63; *SD* = 10,53) and for test B *M* = 43,23 (*SE* = 0,93; *SD* = 15,54). In both approaches, the most frequent score achieved is 64 (*Mod* = 64), while the lowest score is 18 in test A, and 6 regarding the test B. The results are shown in Figure 3.

These results are in line with previous research showing an individual may struggle in one rhythmic task yet perform well in another one (Bonacina et al., 2019; Bonacina et al., 2021; Dalla Bella et al., 2017; Tierney & Kraus, 2015). In similar research with children of similar age, Lee (2008) and Schleuter and Schleuter (1985) have also confirmed that children have better results in duplicating patterns while chanting, then they do when tapping. More specifically, the reasons for having more success in test A could be searched for in the nature of the test

4 The rating procedure was conducted in accordance with similar previous research (for example: Kokas, 1969: 132).

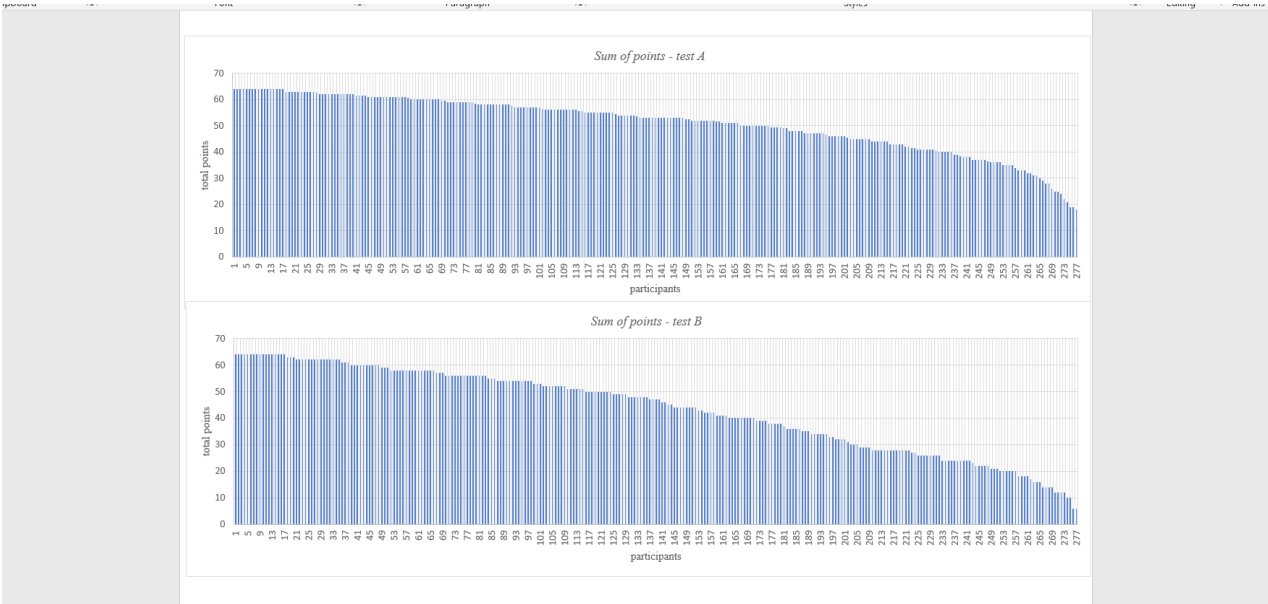

Figure 2. Distribution of results – total points achieved on the test A and test B

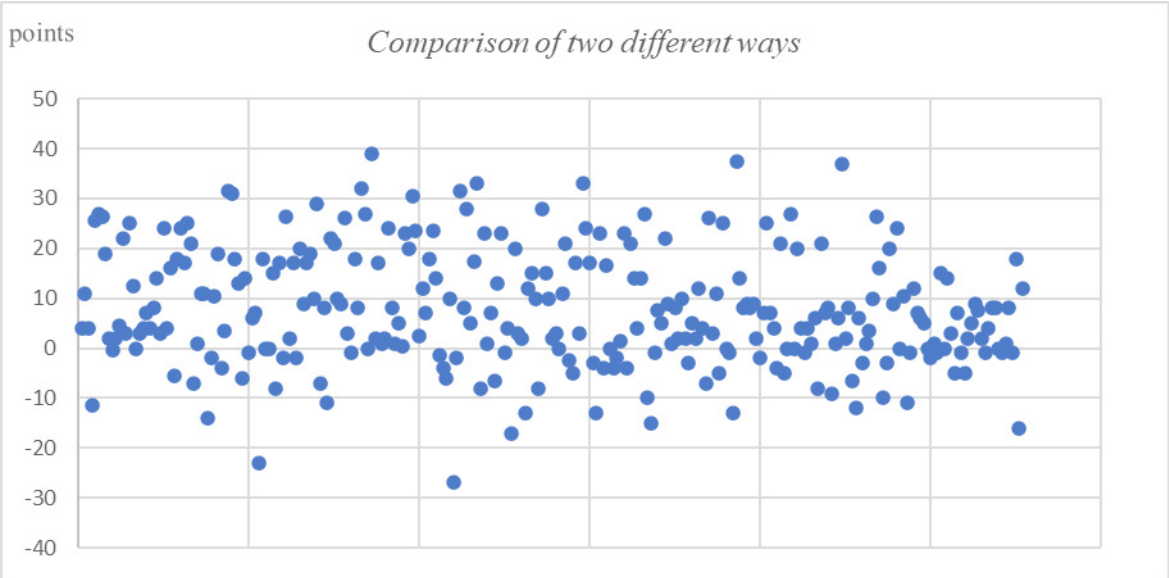

Figure 3. The comparison of two different ways of duplicating rhythmic patterns.

itself – test A contains two simultaneous operations – vocalizing the rhythmic pattern and clapping the beat, but the beat-clapping might have served as a sort of scaffold for better understanding and easier memorizing the rhythmical pattern. Also, test A does not require strong motor skills, since the subject is clapping steady beat, while in test A more or less complex rhythmical pattern, are being clapped. The size of the range in tests results confirms earlier findings that both beat perception ability and rhythmic perception and performance ability vary widely across individuals (Grahn & McAuley, 2009; Grahn & Schuit, 2012).

Concerning the correlation between the points achieved by the first method (test A) and the points achieved by the second method (test B), Spearman's rank correlation ($r = 0,65$; $p = 0,00$), coefficient r indicates a strong correlation between these two methods (Figure 4). The correlation coefficient is significant ($p < 0,05$).

The provided data illustrate a positive correlation, where an increase in the number of points in duplicating rhythmical patterns vocally, using neutral syllable while reproducing the steady beat by clapping hands is associated with a higher number of points duplicating rhythmic patterns by clapping hands as well.

Therefore, since there is an overall tendency that children with higher results in test A also have high results in test B, we could postulate that for these children, with higher level of rhythmic abilities, it is not significant which of these two tests will be used.

Our second research task was to determine if children are more accomplished in duplicating rhythmic patterns in simple or complex tasks: a) within test A; b) within test B.

Regarding the first method of duplicating rhythmic patterns, Wilcoxon Signed Rank Test ($z = -10,246$; $p = 0,00$) presents a statistically significant

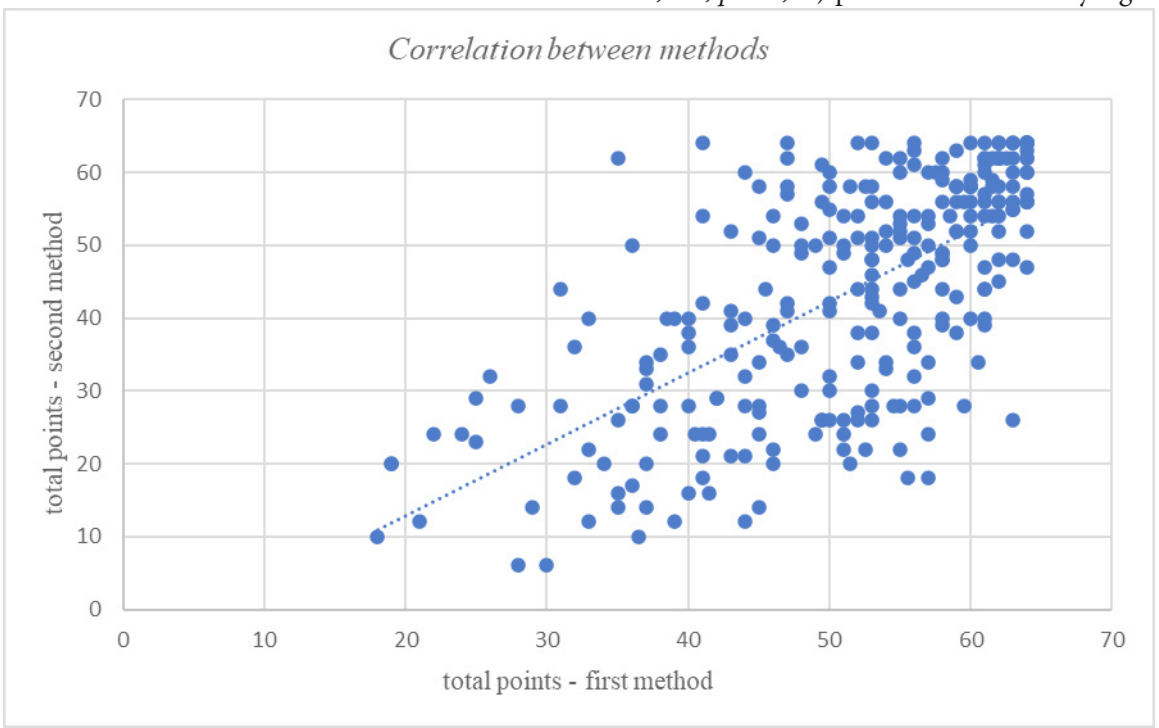

Figure 4. The correlation between the points achieved by the first method and by the second method.

difference in children's achievements performing simple tasks (*Mdn* = 28) opposed to their achievement in duplicating complex tasks (*Mdn* = 26). 276 participants were involved in this analysis. Out of them, 194 children achieve higher success rates in simple tasks, and 44 children perform better in more complex tasks when using this method. A total of 38 children achieved the same number of points on both simple and complex tasks. The mean score of simple tasks duplicating rhythmical patterns vocally, while clapping the beat is *M* = 27,36 (*SE* = 0,24; *SD* = 3,94) and the complex tasks *M* = 23,00 (*SE* = 0,42; *SD* = 6,98). In both types of tasks, the most frequent score achieved is 32 (*Mod* = 32), while the lowest score is 14 regarding the first, and 4 regarding the second type of tasks while duplicating rhythmical patterns.

In the subject of second method – duplicating rhythmical patterns by clapping hands, Wilcoxon Signed Rank Test (*z* = -7,726; *p* = 0,00) indicates a statistically significant difference in children's accomplishment while performing simple tasks (*Mdn* = 24) in contrast to their accomplishment in repeating complex tasks (*Mdn* = 22). Out of 276 participants, who were a part of this analysis, 172 children are more successful in simple tasks, and 76 children are more accomplished in complex tasks when using this method. A total of 28 children achieved the same number of points on both simple and complex tasks. The mean score of simple tasks duplicating rhythmical patterns by clapping hands is *M* = 23,64 (*SE* = 0,39; *SD* = 6,55) and the complex tasks *M* = 19,72 (*SE* = 0,61; *SD* = 10,16). In both types of tasks, the most frequent score achieved is 32 (*Mod* = 32), while the lowest score is 6 regarding the first, and 0 regarding the second type of tasks while duplicating rhythmical patterns by clapping hands.

Although the result confirms that vast majority of children has better results duplicating simple patterns, the number of children having the opposite result is still surprising. The number of children (27,53% of the sample, or 22,68% of the sample, depending on the test type) with higher scores reproducing complex tasks than the simple ones can be explained by the sequence of the patterns within the tests – the complex ones always followed the simple patterns, so the subjects may have got better understanding of the test itself through execution of the simple patterns, or the complex patterns activated their attention in higher extent, since they were more challenging for children, which lead to better results.

Furthermore, we aimed to research are there any difference between the sexes when it comes to duplicating rhythmic patterns in two different ways. That was our third research task.

Firstly, we analysed the first method of duplicating rhythmic patterns – vocally, using neutral syllable while participants are reproducing the steady beat by clapping hands. When considering girls (*n* = 149), the mean score is *M* = 53,77 (*SE* = 0,77; *SD* = 9,39), and with boys (*n* = 129), the mean score is *M* = 47,56 (*SE* = 0,95; *SD* = 10,84). Results suggest that girls are more successful in replicating rhythmic patterns using the first method, so we wanted to explore with Mann-Whitney U test if those differences are statistically significant. The rank test confirmed that the difference between girls (*Mdn* = 56, *n* = 149) and boys (*Mdn* = 49, *n* = 129), *U* = 6 156,50; *z* = -5,170; *p* = 0,00 is statistically significant, and the calculated effect size is considered large in favour of girls.

Following that, we researched are there any differences in sexes while duplicating rhythmical patterns by clapping hands. Regarding girls (*n* = 149), the mean score is *M* = 45,03 (*SE* = 1,21; *SD* = 14,82), and with boys (*n* = 128), the mean score is *M* = 41,13 (*SE* = 1,43; *SD* = 16,13). The findings indicate that girls exhibit greater proficiency in replicating rhythmic patterns using the first method. Consequently, we aimed to investigate the statistical significance of these differences through the Mann-Whitney U test. The rank test confirmed that the difference between girls (*Mdn* = 49, *n* = 149) and

boys (*Mdn* = 43, *n* = 128), *U* = 8 192; *z* = -2,023; *p* = 0,043 is statistically significant, and that the calculated effect size is considered large in favour of girls. These results correspond to those, that found the same difference (Derm et al., 2001; Elisana et al., 2012; Pollatou, et al., 2005; Schleuter & Schleuter, 1985), but we already mentioned that there are many of those which did not confirm this difference (Lee, 2008; Mastrokalou & Hatziharistos, 2007; Thomas & Moon, 1976).

Our last research task was to determine whether there are differences in successfully duplicating rhythmic patterns between participants of different age groups in two different ways.

In relation to the first method of duplicating rhythmic patterns – vocally, using neutral syllable while reproducing the steady beat by clapping hands, the results have shown (Kruskal-Wallas test ($\chi 2$ = 20,459 (2); *p* = 0,00)) that there are significant differences between achievement of different age groups in duplicating rhythmic patterns. A comparative analysis of the different age groups revealed that second-grade pupils (*Mdn* = 56) are significantly more successful than both – the first-grade pupils (*Mdn* = 51,5) (Dann's Test = -41,467; adjusted *p* value = 0,001) and preschool children (*Mdn* = 50) (Dann's Test = -47,366; adjusted *p* value = 0,000). There are no differences between preschoolers and first graders (Dann's Test = -5,889; adjusted *p* value =1,000).

Subsequently, the results indicate (Kruskal-Wallas test ($\chi 2$ = 21,449 (2); *p* = 0,00)) that the second-graders are also more successful in duplicating rhythmic patterns by clapping their hands in comparison to first-graders and preschoolers. A comparative analysis of the different age groups revealed that second-grade pupils (*Mdn* = 53) are significantly more successful than both – the first-grade pupils (*Mdn* = 40) (Dann's Test = -40,701; adjusted *p* value = 0,001) and preschool children (*Mdn* = 39) (Dann's Test = -49,383; adjusted *p* value = 0,000). No distinctions exist between preschoolers and first graders (Dann's Test = -8,683; adjusted *p* value = 1,000).

The results to some extent correspond with many earlier research – second grade children did have significantly better results than preschoolers and first grade children (Bonacina et al., 2019; Elisana et al., 2012; Gardner, 1971; Lee, 2008; Mastrokalou & Hatziharistos, 2007; Weikart, 1982), however, the lack of confirmed differences in results between preschool children and first graders should be a topic of further research. It remained unclear whether the preschoolers had better result than expected, or some sort of stagnation has happened in the first grade.

Conclusions and Implications

Starting in preschool and continuing throughout their schooling, teachers focus on cultivating children's musical abilities. In the field of rhythmic abilities, children are trained to develop some of the elements of rhythmic abilities with different movements and/or vocally. This paper aimed at contributing to the potential improvement of the quality and fairness of the enrolment exam for all participants, through investigation of the possible differences in the results on duplicating rhythmic patterns in two different ways (test A and test B) and comparing the results between the tasks with different level of difficulty, between the three groups of children (preschool, first and second grade of primary school) and between the two genders. Test A included duplicating rhythmic patterns vocally, using neutral syllable while reproducing the steady beat by clapping hands and test B included duplicating rhythmic patterns by clapping hands. The comparison of these two specific tests has not been conducted before and the need for their comparison derived from educational practice, since the two tests are applied as a part of enrolment exam in Serbian music schools and teacher training faculties.

As we noted earlier, many studies confirmed differences in individual's performance across different rhythmic tasks and so did this one. A statistically significant difference in children's successfulness when they duplicate rhythmical patterns vocally, using neutral syllable while reproducing the steady beat by clapping hands (test A) and duplicating rhythmic patterns by clapping hands (test B) has been found. 76,5% of participant had bigger success in test A and 23, 5% were more successful performing test B. This led to conclusion that the second test required stronger motor skills, so the larger range of scores have emerged among the participants. On the other hand, we determined a positive correlation, where an increase in the number of points in test A was associated with a higher number of points in test B, leading to the conclusion that children with stronger rhythmic abilities will have similar success regardless of the test.

The study has also confirmed that a statistically significant difference in children's achievements performing simple tasks opposed to their achievement in duplicating complex tasks – majority of children were more accomplished in duplicating simple rhythmic patterns, rather than complex patterns. The fact that 27,53% of the sample, or 22,68% of the sample, depending on the test type, had better results reproducing complex patterns was possibly connected with the order of patterns within the test.

The difference between girls and boys performing both tests was established, with large statistical significance, in favour of girls. Finally, the study has confirmed, like many different studies noted earlier, there are significant differences between achievement of second grade children and younger children in duplicating rhythmic patterns.

This research has shown that age and gender as factors most likely affect the success of rhythm reproduction, as some of the factors, but not to what extent, nor for what reason. Therefore, this research can serve as a basis for further, future research in this area.

This research, but also the findings of many research listed above indicate that traditional testing procedures within enrolment exams, evaluating children's rhythmical abilities in Serbian education system should be transformed:

- More precise guidelines for the testing procedure within the enrolment test for music schools and teacher training faculties should be developed, in order to have similar and unified testing procedures around the music schools in Serbia for every child.
- The testing process (within the future research, but the enrolment exams as well) should include short introduction to testing procedure, where children would get acquainted with the testing procedure itself – get an opportunity to try/practice the duplication of patterns, so the ones with no previous experience in it would have the same, or at least similar starting positions as the ones who have tried it before.
- The testing procedure within the enrolment test would be altered in such a way to include dividing children into groups based on their age, so that their accomplishments could be compared among the ones in the same age group.

These recommendations should serve as a base for optimal selection of children and indirectly, optimal results of the teaching process in music schools.

Incorporating these specific tasks (replicating rhythmic patterns in both vocal duplication using neutral syllables and rhythmic patterns duplication through hand clapping) into educational practice would enrich the teaching process within Music Culture classes and music-related activities in preschools and ensure that children are well-prepared for rhythm-related tests in music schools. These tasks would familiarize children with different

methods of reproducing rhythm, providing them with the opportunity to achieve their best possible results within the enrolment exam at music schools. In order to enhance their teaching, it is crucial for teachers to be acquainted with the diverse accomplishments that children attain.

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УСПЕШНОСТ У ИЗВОЂЕЊУ РАЗЛИЧИТИХ ЗАДАТАКА РЕПРОДУКЦИЈЕ РИТМИЧКИХ ОБРАЗАЦА ДЕЦЕ ПРЕДШКОЛСКОГ УЗРАСТА, ПРВОГ И ДРУГОГ РАЗРЕДА

Ритам је, у најширем значењу овог појма, једна од кључних компоненти музике; примарни елемент који ствара перцепцију времена (Thaut, 2013: 15). Општеприхваћена дефиниција ритма не постоји. У ширем смислу, ритам се сматра сложеном појавом која се састоји од неколико варијабли – различитих временских компоненти или поделемената као што су такт, темпо, метар и (ритмички) образац (Fraisse, 2013; Thaut et al., 2014). Управо ова мултидимензионална природа ритма имплицира да је очекивано да се јаве разлике у учинку појединаца на различитим ритмичким задацима, јер они укључују употребу вишеструких ритмичких вештина (Bonacina et al., 2019; Bonacina et al., 2021, Dalla Bella et al., 2017; Fiveash et al., 2022; Tierney and Kraus, 2015).

За евалуацију ритмичких способности користе се различити тестови, а међу њима важно место заузима тест ритмичке репродукције. У питању је тест у коме појединац памти и понавља ритмичке обрасце што је прецизније могуће, одмах након што их одслуша. Постоје бројне верзије овог задатка, у зависности од начина на који је ритмички образац првобитно изведен и начина на који бива поновљен. Синхронизација покрета са метричким пулсом или ритмом је задатак који се чини једноставним, али у стварности је сложен процес и његово извршење зависи од аудитивног процесирања, сензомоторне (аудиторно-моторне) синхронизације и фине моторике појединца (Tierney and Kraus, 2013).

У предшколским установама и основним школама у Србији заступљене су различите активности које имају за циљ подстицање ритмичког развоја деце и евентуалне припреме за даље усавршавање у овој области. Ту спадају извођење ритмичке пратње уз бројалице или певање (пулса, ритма или грубисања удара) различитим покретима и извођење ритмичких игара. Поред наведених активности, приликом рада на одржавању равномерне ритмичке пулсације и координације покрета уз музику неизоставне су музичке игре, а међу њима и традиционалне музичке игре са певањем.

Државни школски систем у Србији, поред основних школа, укључује и музичке школе. Пошто су средства ових школа ограничена а „најбољи начин да се осигура да су ресурси добро искоришћени је одабир деце на основу способности" (Hallam, 2006: 55), пријемни испит сматра се неопходним. У овом раду усмерили смо своју пажњу на тај веома важан тренутак када дете уз похађање основне школе или вртића потенцијално започиње своје специјализовано, музичко школовање. Начин на који се музичке способности деце евалуирају у оквиру овог испита није у потпуности стандардизован на националном нивоу – у званичном документу се једино наводи да „На пријемном испиту проверава се слух, ритам, музичка меморија" (Nastavni plan i program osnovnog muzičkog obrazovanja i vaspitanja, 2010: 8). Међутим, испит се тради-

ционално одвија на сличан начин у свим школама и углавном се састоји из неколико задатака. Конкретно, ритмичке способности деце се обично процењују кроз један од два задатка: деца вокално репродукују ритмичке обрасце, користећи неутрални слог, док пљескањем рукама изводе метрички пулс (тест А); деца репродукују ритмичке обрасце пљескањем рукама (тест Б). Одлука о томе који од ова два теста ће бити примењен је произвољна и углавном зависи од одлуке групе наставника која обавља пријемни испит. Сами задаци осмишљавају се најчешће на лицу места, од стране наставника који воде ток испита и њихов ниво комплексности је такође произвољан. Учинак свих ученика се вреднује у оквиру јединствене ранг-листе, независно од њиховог узраста. Иста два теста обично су део процеса процене музичких способности студената, као део пријемних испита за учитељске факултете и високе школе за образовање васпитача у Србији.

Циљ овог рада био је да се допринесе унапређењу квалитета и правичности пријемног испита за све ученике, кроз испитивање могућих разлика у резултатима појединаца између ова два теста, упоређивање резултата између задатака различитог степена комплексности, између три групе деце организоване према узрасту (предшколски, први и други разред основне школе), те на крају и између два пола. Истраживање је спроведено у оквиру школских и предшколских установа у Београду, а узорак је чинило 278 деце.

Ово истраживање потврдило је разлике у учинку појединаца у различитим ритмичким задацима. Утврђена је статистички значајна разлика у успешности деце када изводе ритмичке обрасце вокално, користећи неутрални слог, док истовремено репродукују метрички пулс пљескањем рукама (тест А) и када ритмичке обрасце изводе пљескањем рукама (тест Б). Наиме, 76,5% учесника је имало већи успех на тесту А, а 23,5% је било успешније у извођењу теста Б. Утврдили смо и позитивну корелацију у постигнућу на ова два теста, где је повећање броја поена на тесту А повезано са већим бројем поена на тесту Б. Студија је такође потврдила да постоји статистички значајна разлика у постигнућима деце у репродуковању једноставних ритмичких образаца у односу на њихово постигнуће у репродуковању сложених образаца – већина деце је била успешнија у репродуковању једноставних ритмичких образаца. Утврђена је разлика између девојчица и дечака у оба теста, са великом статистичком значајношћу, у корист девојчица. Коначно, студија је потврдила, као и многе раније поменуте студије, да постоји значајна разлика између успеха деце другог разреда и млађе деце у репродуковању ритмичких образаца, док, са друге стране, ова разлика није евидентирана у постигнућу деце предшколског узраста и деце која похађају први разред.

Указано је на важност осмишљавања прецизнијих смерница за извођење пријемног испита како би се уједначиле процедуре у свим музичким школама у Србији, а које би укључивале кратко упознавање са начинима на који ће бити евалуиране дечје способности и вредновање резултата унутар појединих узрасних група. Рад на репродукцији ритмичких образаца на два наведена начина треба укључити и у музичке активности у предшколским установама и наставу музичке културе у основним школама како би она деца која се определе за учешће на пријемним испитима за музичку школу и од раније била упозната са овим видовима музичког извођења.

Кључне речи: *репродукција ритмичких образаца, ритмичке способности, предшколско музичко васпитање, опште музичко образовање, музичка школа*